

# PATENT COOPERATION TREATY

**PCT**

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

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Date of mailing (day/month/year)

24 November 2000 (24.11.00)

International application No.

PCT/GB00/00989

Applicant's or agent's file reference

P.Q.12,856

International filing date (day/month/year)

16 March 2000 (16.03.00)

Priority date (day/month/year)

16 March 1999 (16.03.99)

Applicant

YIN, Jia, Hong

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

09 October 2000 (09.10.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>7</sup> :</b> <b>H04N 7/18</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 00/56074</b> <b>(43) International Publication Date:</b> 21 September 2000 (21.09.00)						
<p><b>(21) International Application Number:</b> PCT/GB00/00989</p> <p><b>(22) International Filing Date:</b> 16 March 2000 (16.03.00)</p> <p><b>(30) Priority Data:</b></p> <table border="0"> <tr> <td>9906040.2</td> <td>16 March 1999 (16.03.99)</td> <td>GB</td> </tr> <tr> <td>9907857.8</td> <td>7 April 1999 (07.04.99)</td> <td>GB</td> </tr> </table> <p><b>(71) Applicant (for all designated States except US):</b> CENTRAL RESEARCH LABORATORIES LIMITED [GB/GB]; Dawley Road, Hayes, Middlesex UB3 1HH (GB).</p> <p><b>(72) Inventor; and</b></p> <p><b>(75) Inventor/Applicant (for US only):</b> YIN, Jia, Hong [GB/GB]; 3 Watermeadow Lane, Fulham, London SW6 2RW (GB).</p> <p><b>(74) Agent:</b> WALKER, Neville, Daniel, Alan; QED I.P. Services Limited, Dawley Road, Hayes, Middlesex UB3 1HH (GB).</p>		9906040.2	16 March 1999 (16.03.99)	GB	9907857.8	7 April 1999 (07.04.99)	GB	<p><b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b>  <i>With international search report.</i></p>
9906040.2	16 March 1999 (16.03.99)	GB						
9907857.8	7 April 1999 (07.04.99)	GB						
<p><b>(54) Title:</b> CLOSED CIRCUIT TELEVISION (CCTV) CAMERA AND SYSTEM</p>								
<p><b>(57) Abstract</b></p> <p>The invention relates to a CCTV camera and system. Existing CCTV systems sometimes have many cameras which monitor offices, shops or public places. There is often a risk that a detected incident or event is not displayed at a control room at the time when the event occurs. In a preferred embodiment the invention provides a CCTV system in which means is provided at a camera to obtain information indicative of displacement of an object in the field of view (FOV) of the camera. Processing means determines whether said information exceeds a predetermined threshold and if this occurs switches a monitor to receive from said camera(s). The advantage of the invention is that viewed events are displayed automatically at the instant they occur.</p> <div data-bbox="990 1144 1437 1669" data-label="Image"> </div>								

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## CLOSED CIRCUIT TELEVISION (CCTV) CAMERA AND SYSTEM

5 The present invention relates to a closed circuit television (CCTV) cameras and systems, and more particularly to multi camera CCTV systems.

Such multi camera CCTV systems may include tens or even hundreds of cameras. Monitors are installed remote from the cameras and are usually watched by operators in  
10 a central control room or monitoring centre.

Multi camera CCTV systems are used increasingly to improve security and safety in a myriad applications, including offices, car parks, shopping malls, on motorways, railways, and airports.

15

Analogue images obtained by the cameras may be transferred to the monitoring centre by cable which is connected to each camera. The installation of cables may be costly, or may not be practical for some situations where, for instance, only mobile cameras can  
20 be used. In such situations CCTV systems send images via a radio frequency (RF) link. Such RF links have limited bandwidth and therefore limit the amount of cameras which may be used in any one system.

Large amounts of data are produced from digital cameras. Data compression techniques  
25 therefore may be used in wireless (RF) CCTV monitoring systems. However, even these were not able to allow all cameras to transmit at the same time. Therefore operators have had to switch sequentially from one camera to the next in order to monitor premises or check what was happening at a particular location.

30 A problem has been that sometimes an event has occurred at a location which was not being viewed at the time an event occurred.

The present invention arose in an attempt to overcome this and associated problems.

According to a first aspect of the invention there is provided; a camera having means for determining whether information detected in its field of view includes a moving object; processing means for determining whether said moving object exceeds a predetermined threshold; and means for transmitting at least a portion of said moving image to a remote location.

The means to obtain information preferably includes a charge coupled device (CCD) and a microprocessor arranged to discriminate between static and moving pixels or moving portions of an image. Means may be provided to modify a signal so that it is prioritised over another signal. Thus one or more cameras are configured and/or switched automatically to send image data to a monitoring centre when there is an event of interest occurring in the field of view of a camera.

According to another aspect of the present invention there is provided a Closed Circuit Television (CCTV) system including a plurality of CCTV cameras and a communication channel from each of said cameras to at least one monitor; characterised in that means is provided at a camera to obtain information indicative of displacement of an object in the camera's field of view and processing means is provided to determine whether said information exceeds a predetermined threshold, whereby if said threshold is exceeded an override signal is generated, which override signal switches the monitor to receive from said camera.

Each camera may be incorporated with a motion or infra red sensor so that images are transmitted only if movement is detected. Cameras may be adapted to follow or track a moving object. If an infra red motion detector is used to detect presence of an object in a camera's field of view, this may be configured to act as an initial warning or alert that activity is occurring in a particular camera field of view. This information may be used as an initial prioritisation of a transmitted signal and switch a monitor accordingly. In addition a higher priority may be accorded by the processing means and means for determining whether a predetermined threshold is exceeded. This is because the higher priority has associated with it a quantitative element. Thus, for example, the former

embodiment may be activated by animals such as birds or cats; whereas when combined with the latter embodiment discrimination of such events is provided.

Means may also be provided to detect areas of interest and/or to obtain information indicative of features in the images. Preferably means is provided to determine whether said information contains data indicative of any events of interest for the purposes of surveillance and monitoring. If said data is obtained and/or exceeds a predetermined threshold, an override signal is generated, which override signal switches a transmitter to transmit the image data of said camera to a monitor. The invention enables one or more portions of an image frame to be transmitted, if for example, these areas of interest contain events of interest and there is a risk of a channel reaching its capacity. Thus in the unlikely event of several cameras transmitting data at the same time, a monitor may be adapted to receive images from more than one camera at the same time, for example, by reconfiguring a screen into two or more sections. Alternatively an image store, such as a buffer, may be provided. The image store enables once retrieved, an image to be viewed at a different time from another.

Means is preferably also provided to determine which portion of the data is useful and which portion of the data is superfluous, such as static objects. Advantageously means is provided to encode data to be transmitted in for example, MPEG 4 format, so as to reduce the amount of transmitted data.

The means to obtain information preferably includes a charge couple device (CCD) and a microprocessor, frame store, and/or dedicated circuits such as ASIC's, to discriminate pixel features. The said microprocessor and ASIC's may be configurable and programmable, and may be able to communicate with other cameras via one or more communication channels.

Actuator means for displacing the field of view of the camera may be provided. The actuator means may be operated under control of a microprocessor which is arranged to displace the camera so that objects of interest are maintained within a field of view.

Artificial intelligence, for example in the form of a neural network, may be included in the system.

5 In order to increase channel carrying capacity means may be provided to discriminate moving portions of an image and image portions occupied by objects. Discriminating moving portions of an image may be implemented by a motion detector using consecutive images. Discriminating image portions occupied by an objects may be implemented by object detector using an adopted reference image containing only background image information.

10

Means may also be provided to detect movement direction, or main direction of movement if there are multiple directions in the view of camera, so that the camera may be adapted to follow or track the moving object/objects.

15 Embodiments of the invention will now be described, by way of example only, and with reference to the Figures, in which:

Figure 1 shows a block diagram of an example of a camera in accordance with the invention;

20

Figure 2 shows a functional block diagram of a camera processing unit;

Figure 3 shows a block diagram of a moving edge detector which is incorporated into the camera to detect moving objects;

25

Figure 4 shows a block diagram of an object detector; and

Figure 5 is an overall view of a system including four cameras.

30 Figure 1 shows a block diagram of a camera 2, which includes Processing Unit 10 and MPEG 4 encoder 4. An actuator 8 is provided to move camera 2 in a controlled

manner, eg, by tilting, panning or zooming. Processing unit 10 is shown in greater detail in Figure 2.

Referring to Figure 1, camera 2 has a lens 6 and an image detector which is preferably a charge coupled device (CCD). Outputs of camera 2 are a transmission Request Signal, to request a transmitter to transmit data when there is an event detected and Tracking Control signal, to control actuator 8 to follow event movement. Whole Image is the same image as obtained from a normal camera. Area of Interest (AOI) Image outputs images in area of interest. MPEG 4 Image outputs MPEG 4 encoded images of an AOI Image.

Operation of the camera will now be described, with reference to Figure 2. Referring to Figure 2, three frames of sequential video images 11 are stored in three frame stores, FS1 21, FS2 22 and FS3 23. Using the three images, a moving edge detector 31 detects moving edges in an image and generates a moving edge image. A reference image 32 containing only background image data is used to compare with sequential images in order to detect whether objects are present in the camera's field of view. The reference image may automatically be adopted whenever there is not an object detected so as to overcome the problem of change of ambient lighting conditions. By comparing a reference image 32 with images from FS2 22, the object detector 33 detects whether or not there are events of interest present in the images.

Using the information inherent in moving edge images, and of objects detected, three features can be detected. These are: events of interest, directions of moving objects and areas of interest. Detection is by way of high level of analysis. Interest Analyser 43 estimates whether there is an event of interest in the field of view. This may be an object/or person present, or just a static background. From the event of interest detected, means for decision making 50 determines when or which images are to be transmitted. Area of interest (AOI) analyser 42 measures an area of interest in the image in the region where an event of interest is detected. Thus, only data in AOI is transmitted. Other parts of the image are ignored as they are relatively static and therefore discarded. Thus bandwidth is saved. By using the technique of block matching, direction analyser



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41 detects an overall direction of movement of the event. This information may be used to control an actuator so that if present, actuator 15 controls camera 2 in order to follow an event of interest.

- 5 From the three variables: events of interest, directions of moving objects and areas of interest, decision making means 50 generates three signals, A, B and C. Signal A informs image buffer 60 to be ready to send an image and which part of the image is to be sent. Signal B requests transmitter to transfer images by overriding any existing channel. Signal C controls camera 10 in Figure 1 so that it tracks the events of interest if  
10 necessary, by tilt, pan or zoom. The image is then encoded by MPEG 4 encoder and transmitted either via a hardwire (fibre optic) connection or as an rf, VHF or UHF signal.

- Moving edge detector is illustrated diagrammatically in Figure 3. Three consecutive  
15 images of sequential video images 11 are stored in three frame stores, FS1 21, FS2 22 and FS3 23, and used for moving edge detection.  $I_1(x,y)$ ,  $I_2(x,y)$  and  $I_3(x,y)$  denote the three consecutive images respectively. The input of Edge Detection 32 is  $I_2(x,y)$  and its output is  $E_2(x,y)$  is an edge image from image  $I_2(x,y)$ . Inputs of temporal difference (1)  
31 are  $I_1(x,y)$  and  $I_2(x,y)$ , and output is a difference image  $D_{12}(x,y)$  which is defined as  
20 the following equation:

$$D_{12}(x,y) = |I_1(x,y) - I_2(x,y)| \quad \text{Eqn (1)}$$

- 25 The inputs of temporal difference (2) 33 are  $I_2(x,y)$  and  $I_3(x,y)$ , and its output is a difference image  $D_{23}(x,y)$  which is defined in equation 2 as the follows:

$$D_{23}(x,y) = |I_2(x,y) - I_3(x,y)| \quad \text{Eqn (2)}$$

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The inputs of Multiplication 41 are  $D_{12}(x,y)$ ,  $E_2(x,y)$  and  $D_{23}(x,y)$  and its output  $M(x,y)$  is calculated as the follows:

$$M(x,y) = D_{12}(x,y) \cdot E_2(x,y) \cdot D_{23}(x,y) \quad \text{Eqn (3)}$$

- 5 The output of threshold device 42 is the moving edge image  $ME(x,y)$  12, which is defined as follows:

$$ME(x,y) = \begin{cases} M(x,y), & \text{if } M(x,y) > T_m \\ 0, & \text{Otherwise} \end{cases} \quad \text{Eqn (4)}$$

10

where  $T_m$  is a threshold for moving edge detection.

- An example of object detector is illustrated in Figure 4. Frame store FS2 21 contains the input image 11, which is one of the sequential images of camera 2 and may contain objects. Reference Image 22 is a frame store containing a reference image which contains only background image. The reference image may automatically be adopted by input image 11 whenever there is not an object detected in the image. Thus, the problem of changes in light intensity can be overcome. Let  $I_2(x,y)$  and  $R(x,y)$  denote the image in FS2 and the reference image respectively. By comparing  $I_2(x,y)$  and  $R(x,y)$ , the Intensity Subtraction 23 generates a difference image  $D(x,y)$ , which is calculated as the follows:

$$D(x,y) = | I_2(x,y) - R(x,y) | \quad \text{Eqn (5)}$$

- 25 Then, using a technique of thresholding, the output  $O(x,y)$  of thresholding means 31 is defined as follows:

$$O(x,y) = \begin{cases} 1, & \text{if } d(x,y) > T_o \\ 0, & \text{Otherwise} \end{cases} \quad \text{Eqn (6)}$$

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where 1 indicates that the pixel is an object pixel, 0 indicates that the pixel is a background pixel, and  $T_o$  threshold for object detection.

5 Through analyser 32, the output signal 12 indicates whether an object or objects have been detected.

Figure 5 is a diagrammatical overall view of a system 100 including four cameras 100A, B, C and D. Cameras 100 A and B are connected to a monitoring station 104 via hard wire connectors. Cameras 100C and D are connected to monitoring station 104 via rf transmitters 106C and 106D and via rf receiver 108.

10 Monitoring station 104 is connected to a plurality of monitors 110 of which only one is shown. The screen 112 of the monitor is capable of being divided into four sections and images from one or more cameras displayed in the or each section.

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The invention has been described by way of examples only and variation may be made to the embodiments described without departure from the scope of the invention.

**CLAIMS**

5

1. A camera having means for determining whether information detected in its field of view includes a moving object; processing means for determining whether said moving object exceeds a predetermined threshold; and means for transmitting at least a portion of said moving image to a remote location.

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2. A camera according to claim 1 wherein the means for transmitting at least a portion of said moving image is a radio frequency (rf) transmitter.

15

3. A camera according to claim 1 or 2 wherein the camera has an actuator arranged to tilt, pan or zoom.

4. A camera according to claim 1, 2 or 3 wherein at least one motion sensor is included so that images are transmitted only if movement is detected.

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5. A Closed Circuit Television (CCTV) Camera and System including a plurality of CCTV cameras and a communication channel from each of said cameras to at least one monitor; characterised in that means is provided at a camera to obtain information indicative of displacement of an object in the camera's field of view and processing means is provided to determine whether said information exceeds a predetermined threshold, whereby if said threshold is exceeded an override signal is generated, which override signal switches a monitor to receive from said camera.

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6. A system according to claim 5 wherein the means to obtain information includes a charge coupled device (CCD) and a microprocessor arranged to discriminate between static and moving pixels or moving portions of an image.

- 7.

7. A system according to claim 5 including artificial intelligence, for example, in the form of a neural network.

5

8. A method of transmitting image data, obtained by a camera, to a remote location, comprising the steps of: determining whether an object, in the field of view of the camera, is moving and if so whether it exceeds a predetermined threshold; generating an override signal if said threshold is exceeded, transmitting at least a portion of the image data with the override signal to a remote location; said override signal being configured so as to switch a monitor, at the remote location, to display said portion of image.

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Fig.1.

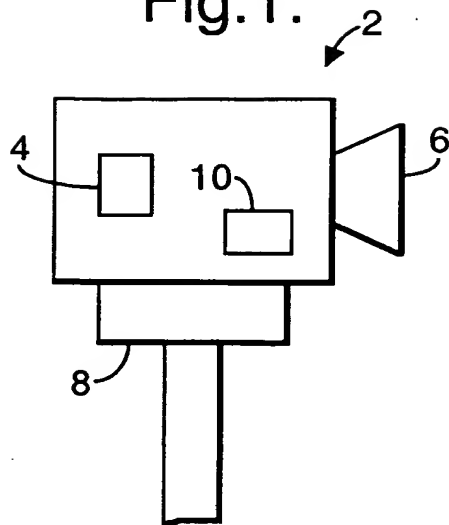


Fig.2.

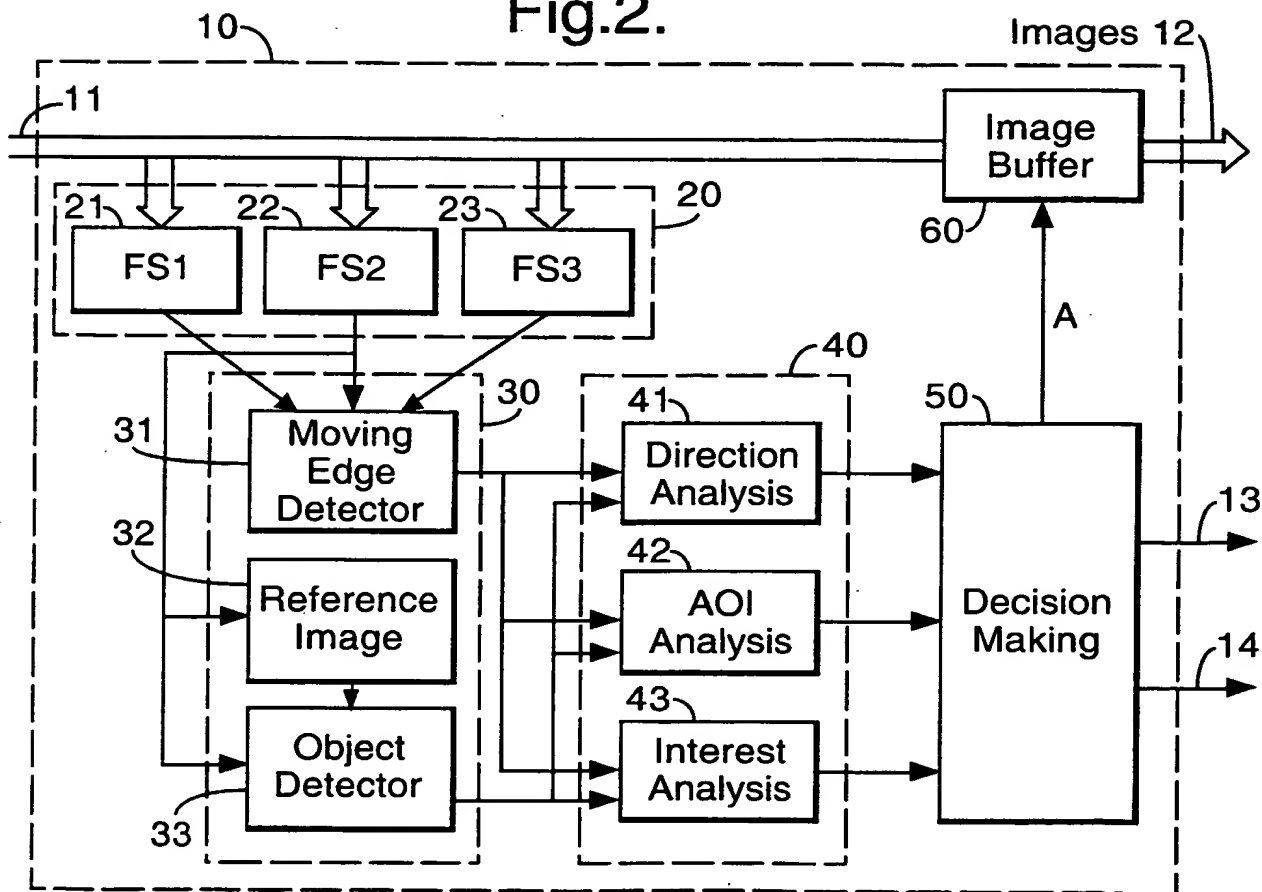


Fig.3.

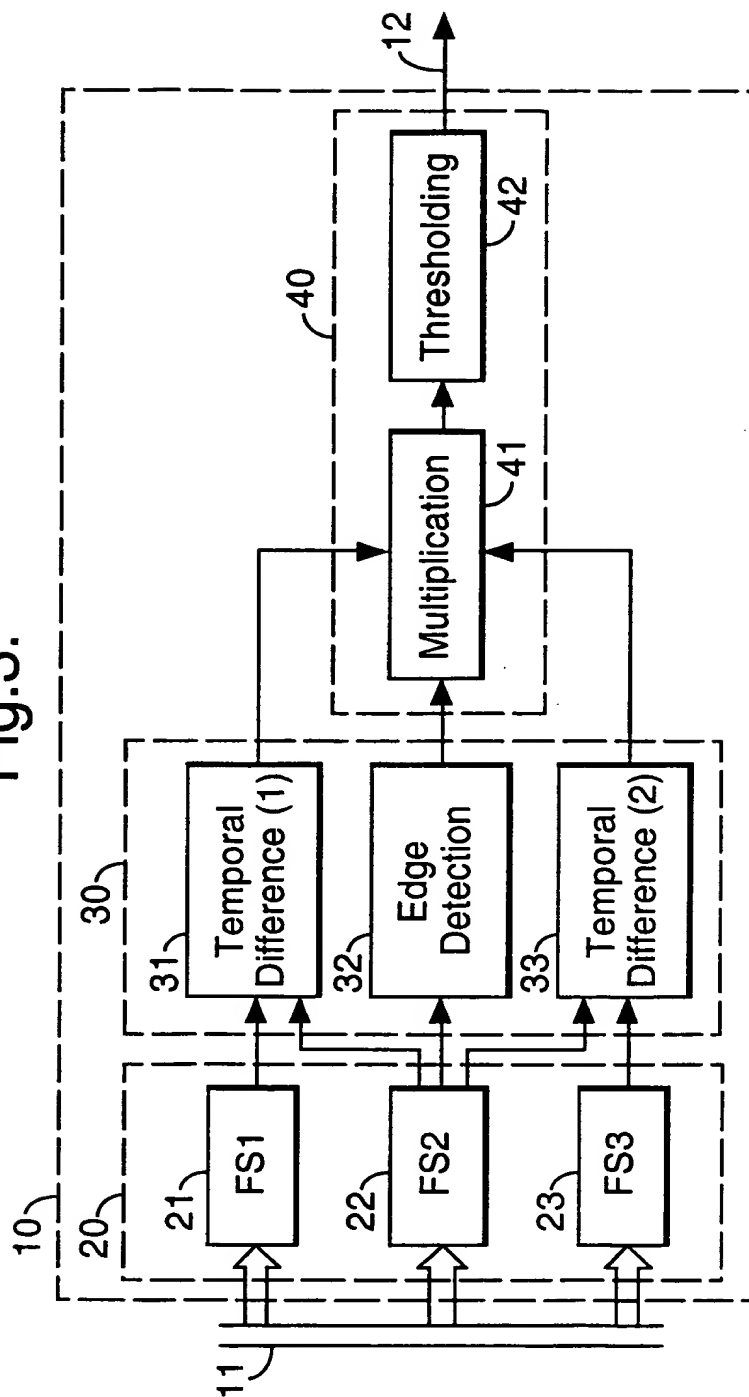
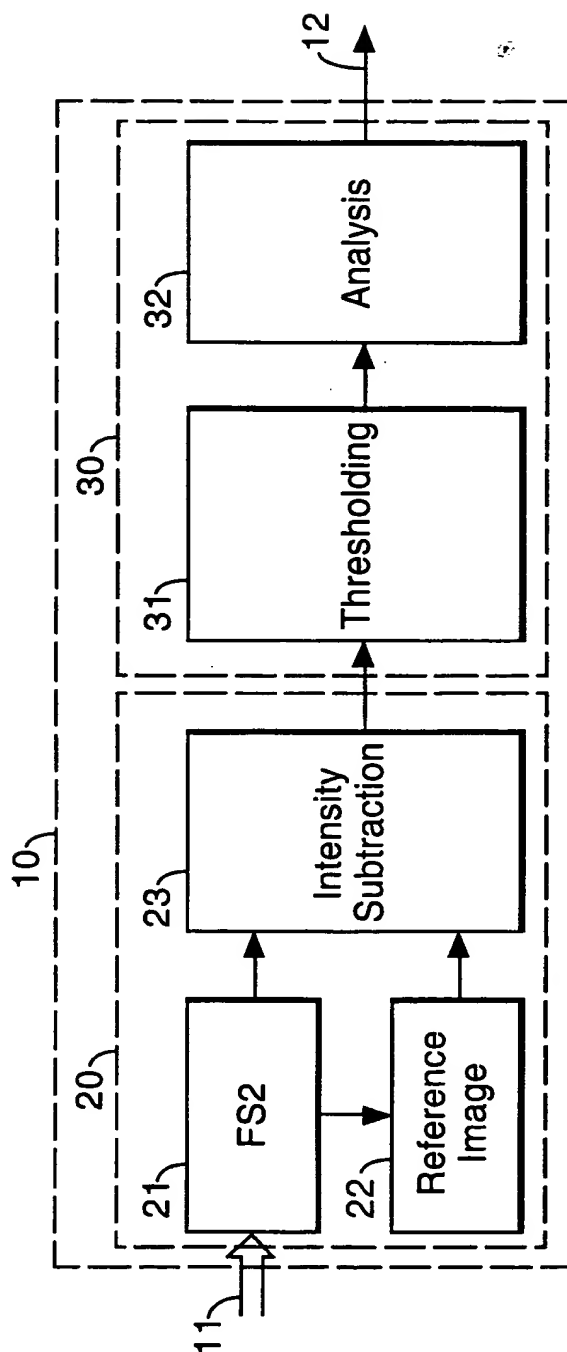


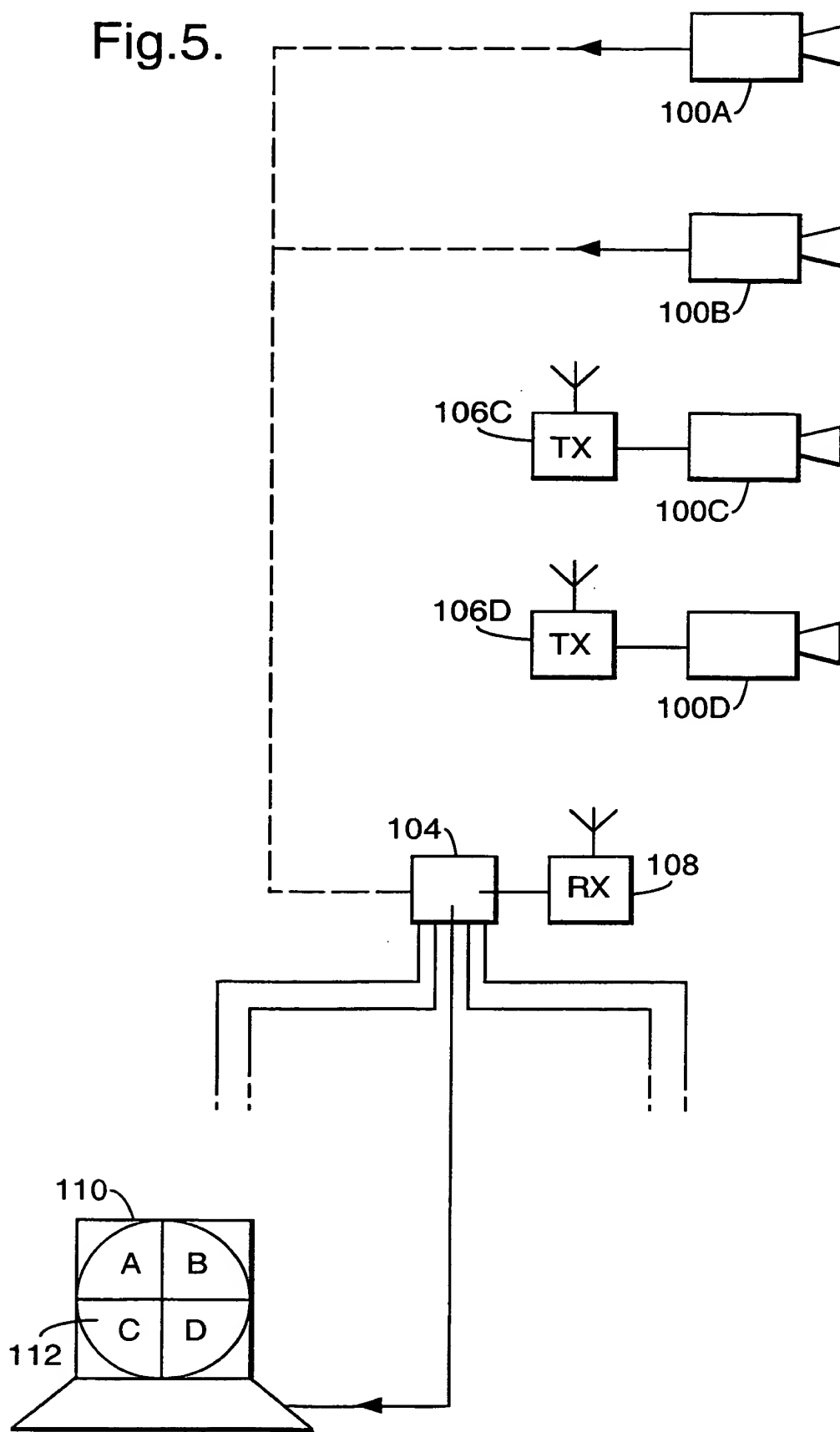
Fig.4.





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Fig.5.



## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>P.Q.12,856</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 00/ 00989</b>	International filing date (day/month/year) <b>16/03/2000</b>	(Earliest) Priority Date (day/month/year) <b>16/03/1999</b>
Applicant  <b>CENTRAL RESEARCH LABORATORIES LIMITED</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

## 1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

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☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

## 4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

## 5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

## 6. The figure of the drawings to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1

☐ None of the figures.

## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 00/00989

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04N7/18

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04N G08B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 028 933 A (ASCOTTS LTD) 20 May 1981 (1981-05-20)	1,5,8
A	page 4, line 23 -page 5, line 29 ---	2-4,6,7
Y	EP 0 729 036 A (SANYO ELECTRIC CO) 28 August 1996 (1996-08-28)	1,8
A	the whole document ---	2-7
Y	WO 94 17636 A (BELL COMMUNICATIONS RES) 4 August 1994 (1994-08-04)	5
A	page 1, line 30 -page 2, line 25 ---	1-4,6-8
A	EP 0 823 821 A (NCR INT INC) 11 February 1998 (1998-02-11)	1-8
	the whole document ---	
	--- -/--	

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

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"&amp;" document member of the same patent family

Date of the actual completion of the international search

9 May 2000

Date of mailing of the international search report

18/05/2000

Name and mailing address of the ISA

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Authorized officer

Greve, M

## INTERNATIONAL SEARCH REPORT

International Application No

GB 00/00989

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 719 048 A (AT & T CORP) 26 June 1996 (1996-06-26) abstract ---	1-8
A	US 3 988 533 A (MICK PETER ET AL) 26 October 1976 (1976-10-26) abstract ---	1-8
A	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 01, 31 January 1997 (1997-01-31) & JP 08 241414 A (MATSUSHITA ELECTRIC IND CO LTD; TOKYO ELECTRIC POWER CO INC:THE), 17 September 1996 (1996-09-17) abstract -----	1-8

# INTERNATIONAL SEARCH REPORT

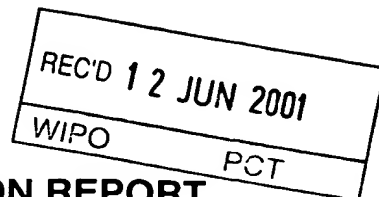
Information on patent family members

International Application No

GB 00/00989

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0028933	A	20-05-1981	GB 2064189 A	10-06-1981
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## PCT



## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference P.Q.12,856	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB00/00989	International filing date (day/month/year) 16/03/2000	Priority date (day/month/year) 16/03/1999
International Patent Classification (IPC) or national classification and IPC H04N7/18		
Applicant CENTRAL RESEARCH LABORATORIES LIMITED		

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 5 sheets, including this cover sheet.
  - ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 4 sheets.

## 3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  09/10/2000	Date of completion of this report  08.06.2001
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Berst, C  Telephone No. +49 89 2399 8028  

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00989

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

### Description, pages:

1,3-8 as originally filed

2,2A as received on 25/05/2001 with letter of 18/05/2001

### Claims, No.:

1-6 as received on 25/05/2001 with letter of 18/05/2001

### Drawings, sheets:

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00989

- ☐ the description,      pages:
- ☐ the claims,      Nos.:
- ☐ the drawings,      sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Yes:	Claims	1-6
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-6
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-6
	No:	Claims	

2. Citations and explanations  
**see separate sheet**



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB00/00989

V). Reasoned statement under Article 35(2) PCT:

- 1). Reference is made to the following documents cited in the International Search Report:

(D1) : US - A - 3 988 533

(D2) : EP - A - 0 028 933

(D3) : EP - A - 0 729 036

- 2). The closest prior art is represented by the document D1 which discloses a camera with motion and intrusion detection, comparing two subsequent images point by point and further comparing the result to a threshold. Detections are performed according to portions of the image in order to focus and zoom in. Upon a detection, an alarm is triggered and a digital image in form of a "map" of the alarmed areas is generated, and finally the video signal is recorded.

D2 discloses a surveillance system comprising a detection of movement on a plurality of cameras connected on a closed circuit. Detection of movement triggers e.g. the recording of a sequence from a given camera in a memory (e.g. VCR). The live or recorded images are transmitted, upon request, by e.g. radio connection to a remote location to be recorded or displayed on a monitor.

D3 discloses an apparatus for determining the movement of an object occupying a point of a screen in order to track it. The movement detection is performed on a block basis, selected according to a comparison with a threshold.

The other documents cited in the International Search Report disclose background art.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB00/00989

In the present demand, in order to perform a surveillance of a region, a closed circuit television system performs a combined detection of events of interest by detecting the presence of an object in the region and also detecting a motion according to a moving edge detection scheme. The resulting signals trigger decision means which allow to selectively transmit only signals of interest to a monitoring location.

Such a combined surveillance system is disclosed in apparatus claim 1.

For these reasons, independent apparatus claim 1 satisfies the requirements of the PCT with respect to Articles 33 (1)-(4).

Claims 2 - 6 are dependent on claim 1 and, therefore, also meet these requirements of the PCT.

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Although it is generally known, e.g. from US-A-3 988 533 and from EP-A-0 028 933, that it is desirable to convey video signals derived from plural surveillance cameras to a remote monitoring location over communication channels, and to limit either the amount of information transmitted over the channels or that utilised at said location, there remains a need for intelligent camera-based systems that make efficient use of the communications bandwidth available by reliably and automatically selecting and prioritising video signals relating to events of interest.

According to the invention there is provided a closed circuit television (CCTV) system for surveillance of a region, the system comprising a plurality of video cameras viewing said region and at least one communication channel linking said cameras to a monitoring location remote from the region under surveillance, wherein the system further comprises processing means for processing video output signals provided by a camera to generate information relating to events of interest; the processing means comprising detection means for generating detection signals indicative of objects appearing in the camera's field of view and motion determining means for generating motion signals indicative of motion of detected objects, and means for conveying over said at least one communication channel for review at said monitoring location only video signals containing information about said events of interest, characterized in that (a) the motion determining means comprises a moving edge detection means for providing said motion signals; (b) said processing means comprises further means for operating upon said detection signals and said motion signals to provide further signals indicative of the direction of motion of detected objects, of an area of interest, within said field of view, at which an event of interest is occurring, and of a degree of interest attaching to the event; (c) thresholding means is connected to receive signals output from said moving edge detection means and arranged to

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supply said motion signals to said further means only when the movement of said edges exceeds a motion threshold level; and (d) decision means is provided for operating upon said further signals to generate control signals for selecting information to be conveyed over said at least one communication channel to said monitoring location.

Such a system preferably includes a charge coupled device (CCD) and a microprocessor arranged to discriminate between static and moving pixels or moving portions of an image. Means may be provided to modify a signal so that it is prioritized over another signal. Thus one or more cameras are configured and/or switched automatically to send image data to a monitoring center when there is an event of interest occurring in the field of view of the camera.

Each camera may be incorporated with a motion or infra red sensor so that images are transmitted only if movement is detected. Cameras may be adapted to follow or track a moving object. If an infra red motion detector is used to detect presence of an object in a camera's field of view, this may be configured to act as an initial warning or alert that activity is occurring in a particular camera field of view. This information may be used as an initial prioritization of a transmitted signal and switch a monitor accordingly. In addition a higher priority may be accorded by the processing means and means for determining whether a predetermined threshold is exceeded. This is because the higher priority has associated with it a quantitative element. Thus, for example, the former

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## CLAIMS:

1. A closed circuit television (CCTV) system for surveillance of a region, the system comprising a plurality of video cameras (2, 100A, 100B, 100C, 100D) viewing said region and at least one communication channel linking said cameras to a monitoring location (104, 108) remote from the region under surveillance, wherein the system further comprises processing means (30, 40, 50) for processing video output signals provided by a camera to generate information relating to events of interest; the processing means comprising detection means (33) for generating detection signals indicative of objects appearing in the camera's field of view and motion determining means (31) for generating motion signals indicative of motion of detected objects, and means (50, 60) for conveying over said at least one communication channel for review at said monitoring location only video signals containing information about said events of interest, characterized in that (a) the motion determining means (31) comprises a moving edge detection means for providing said motion signals; (b) said processing means comprises further means (41, 42, 43) for operating upon said detection signals and said motion signals to provide further signals indicative of the direction of motion of detected objects, of an area of interest, within said field of view, at which an event of interest is occurring, and of a degree of interest attaching to the event; (c) thresholding means is connected to receive signals output from said moving edge detection means and arranged to supply said motion signals to said further means only when the movement of said edges exceeds a motion threshold level; and (d) decision means (50) is provided for operating upon said further signals to generate control signals for selecting information to be conveyed over said at least one communication channel to

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said monitoring location.

2. A system according to claim 1 characterized by the provision of a buffer means (60) connected to receive said video output signals and wherein said buffer means (60) is controlled by said control signals.
3. A system according to claim 1 or claim 2 characterized in that said detection means (33) for generating detection signals indicative of objects appearing in the camera's field of view comprises means for comparing, pixel by pixel, the intensity of video output signals from said camera with a reference image, for comparing intensity differences with a detection threshold level and arranged to supply said detection signals to said further means only when the intensity difference exceeds said detection threshold.
4. A system according to any preceding claim characterized in that, when selected information is conveyed to said monitoring station, said decision means generates an override signal according priority to the selected information.
5. A system according to any preceding claim characterized in that, when selected information is conveyed to said monitoring station, said decision means generates camera control signals capable of causing said camera to execute tilt, pan or zoom functions.
6. A system according to any preceding claim characterized in that at least one of said cameras has associated therewith an infra red presence detector.